

## Thermal Energy Conversion, Phase I

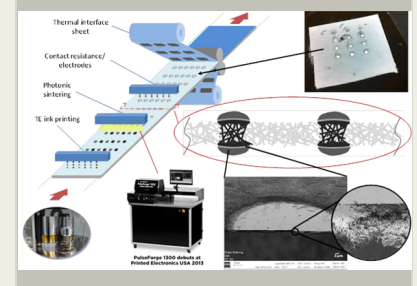
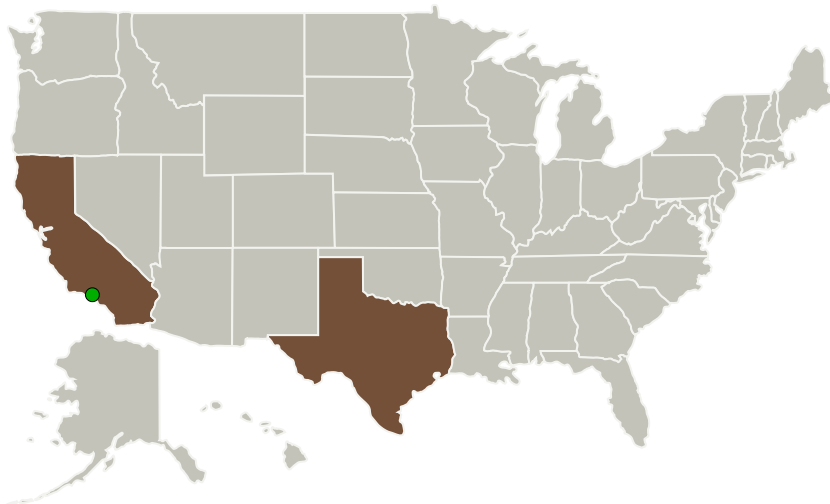
Completed Technology Project (2016 - 2016)



## Project Introduction

Solid-state thermoelectric (TE) devices provide many advantages in refrigeration (TE coolers) and power generation (TE generators). These highly reliable devices have no moving parts, operate over a large range of temperatures, and do not emit toxic or environmentally-unfriendly gases. These devices can be easily integrated into thermal energy conversion systems that meet NASA's needs for innovative space power generation on orbiting platforms, extraterrestrial surfaces, and space transportation vehicles. To date, the adoption of TE generator (TEG) devices in energy scavenging/power recovery applications has been hampered by three primary challenges: - Lack of thermoelectric material compositions with large figures of merit, ZT, that function over a range of operating temperatures - Lack of high throughput production methods that enable large-area, conformable TEG devices - High cost-per-unit area for tiling rigid plate TE devices Production of large-area sheets of high-ZT TEG devices that conform to space vehicle and other relevant thermal gradient surfaces acting to scavenge waste heat need specific processes (e.g. roll-to-roll). Nanohmics Inc. proposes to develop thermoelectric devices based on sintering of high-ZT thermoelectric powders. This TEG fabrication method will enable large-area, conformable devices with 1) high thermal-to-electric conversion efficiency, 2) high areal power conversion ( $\text{W}/\text{cm}^2$ ), 3) large total power recovery (W), 4) high specific power ( $\text{W}/\text{kg}$ ), 5) low fabrication cost ( $\$/\text{W}$ ), and 6) durability and long operational life.

## Primary U.S. Work Locations and Key Partners



Thermal Energy Conversion, Phase I

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## Thermal Energy Conversion, Phase I

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Organizations Performing Work	Role	Type	Location
Nanohmics, Inc.	Lead Organization	Industry	Austin, Texas
● Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Texas

## Project Transitions

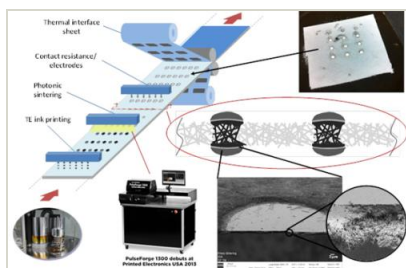
▶ **June 2016:** Project Start

✓ **December 2016:** Closed out

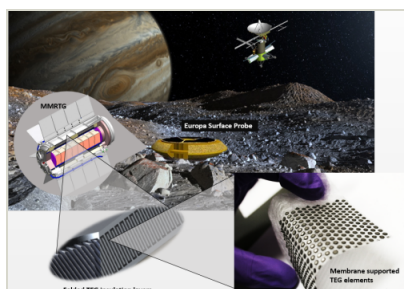
**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/140862>)

## Images

**Briefing Chart Image**

Thermal Energy Conversion, Phase I  
(<https://techport.nasa.gov/image/128609>)

**Final Summary Chart Image**

Thermal Energy Conversion, Phase I Project Image  
(<https://techport.nasa.gov/image/135009>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Nanohmics, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Steve Savoy

**Co-Investigator:**

Steve Savoy

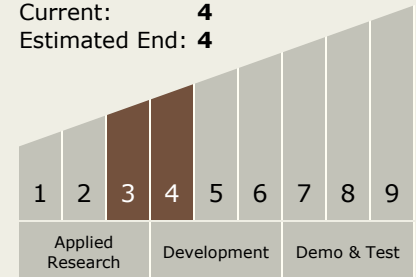
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## Technology Maturity (TRL)

Start: **3**  
Current: **4**  
Estimated End: **4**



## Technology Areas

### Primary:

- TX03 Aerospace Power and Energy Storage
  - └ TX03.1 Power Generation and Energy Conversion
    - └ TX03.1.4 Dynamic Energy Conversion

## Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System